Investment Shocks and Asset Returns: International Evidence*

Ruchith Dissanayake† University of Alberta

Akiko Watanabe‡ University of Alberta

Masahiro Watanabe§ University of Alberta

May 18, 2017

JEL Classification: G12

Keywords: investment-specific technology shocks, investment-minus-consumption factor, international equity markets, economic development, value premium.

*We thank Kohei Aono (Nippon FA discussant), Po-Hsuan Hsu, Jun Nagayasu (JEA discussant), Dimitris Papanikolaou, Thiago de Oliveira Souza (FMA discussant), Tai David Yi, Sean Sehyun Yoo and session participants at the Development Bank of Japan, 2016 Financial Management Association Meetings, Japanese Economic Association Meetings, Nippon (Japanese) Finance Association Meetings for helpful comments. Akiko Watanabe and Masahiro Watanabe acknowledge the financial support from the Social Sciences and Humanities Research Council of Canada.

†Contact author. University of Alberta, School of Business - Finance, Edmonton, Alberta T6G 2R6, Canada. E-mail: ruchith@ualberta.ca, URL: http://www.ruchithdissanayake.com/

‡University of Alberta, School of Business - Finance, Edmonton, Alberta T6G 2R6, Canada. Phone: 780-492-0385, fax: 780-492-3325, email: akiko.watanabe@ualberta.ca, URL: http://www.business.ualberta.ca/AkikoWatanabe/

§University of Alberta, School of Business - Finance, Edmonton, Alberta T6G 2R6, Canada. Phone: 780-492-7343, fax: 780-492-3325, email: masahiro.watanabe@ualberta.ca, URL: http://www.ualberta.ca/~masa/

Investment Shocks and Asset Returns: International Evidence

ABSTRACT

Using a large cross section of stocks from over thirty countries, we examine the implications of investment-specific technological shocks for asset prices and macroeconomic quantities. We find that the negative risk premium associated with the investment shock is stronger and often significant in developed markets with greater access to capital, superior financial institutions, and stronger product market competition. The investment premium is related to, but not subsumed in, the value premium. The results underscore the importance of allocative efficiency in the pricing of technological advances, and help reconcile the conflicting existing evidence from the U.S. market with different sample periods.

1 Introduction

Investment-specific technological change, technological innovation implemented through the formation of new capital stock, promotes economic growth. Firms allocate resources to efficiently produce output, from which households derive utility.[1] Real investment thus affects the households' consumption stream and hence their pricing of claims to the firms' output. Despite this clear link between macroeconomy and finance, researchers have not agreed on the implied pricing relation. We find that pricing crucially depends on the availability of financial institutions, access to capital, and product market competition using a large panel of firms from developed and emerging markets.

Most recent literature casts the above macroeconomics-finance nexus in tightly restricted general equilibrium and reaches different conclusions. The disagreement originates in modeling differences that ultimately associate investment-specific technological shocks with either an increase (Papanikolaou (2011), Kogan, Papanikolaou, and Stoffman (2017)) or a decrease (Garlappi and Song (2016*b*), Li, Li, and Yu, (2017)) in household's marginal utility of wealth. The former implies a negative premium of investment shocks, while the latter does a positive premium. Interestingly, each of these opposing views is supported by empirical evidence. Using post-1963 data in the U.S., Papanikolaou (2011), Kogan and Papanikolaou (2013), and Kogan and Papanikolaou (2014) estimate negative premiums on investment shocks. In contrast, using longer, post-1930 data, Garlappi and Song (2016*a*) find results consistent with positive premiums in the U.S. market. The contrast in conclusion within a single market is striking. The key to reconciling the empirical discrepancy

[1] Following the recent literature, this article refers to innovations in investment-specific technology as investment shocks.

appears to be the sample period. In fact, Garlappi and Song (2016*b*) confirm a negative investment premium for the post-1963 period, suggesting the possibility that the pricing of investment shocks is positive in an early stage of an economy and turns negative as it matures.

Motivated by this observation, we examine the pricing of investment-specific technological innovations by expanding the cross section of economies, rather than the sample period, to seek heterogeneity in economic stages. Specifically, we employ a large sample of firms from 33 countries. Given the economic heterogeneity, we expect to estimate a range of investment-shock premiums, which we seek to explain by country characteristics. This allows us to potentially identify the pricing mechanisms that are unmodeled in the theoretical literature. Thus, we aim to conduct not only an out-of-sample test of existing theory, but also an empirical exploration into new theory.

Following Papanikolaou (2011), we construct a mimicking portfolio long investment-good producers minus consumption-good producers (IMC) to approximate investment shocks. We choose this framework as it closely follows the literature in which the debate on investment-shock pricing arises. Despite a potential concern about data limitation, we find that the necessary data for variable construction are available for a wide range of countries. We examine the pricing of the investment-specific technological shock in both time series and cross section. The former is the time-series mean of the monthly return spread between two extreme IMC-beta sorted portfolios, while the latter is the cross-sectional premium on the factor estimated from a one-step generalized method of moments (GMM) procedure. For robustness, we estimate the investment-shock premiums in both the local and U.S. currencies.

Our contributions are threefold. Firstly, we document a spectrum of risk premiums associated with the investment shock ranging in both magnitude and sign, with more prevalence on the negative side. Approximately, two-thirds of sample countries exhibit negative investment-shock premiums in both time series and cross section, regardless of weighting or currency of measurement. Several of them, mostly developed countries, have significantly negative premiums. There are also a few countries with positive premiums, all from emerging markets. The significantly negative estimates tend to be observed in more mature markets, and positive ones in less mature markets, consistent with the aforementioned evidence from the U.S. market using recent and earlier periods, respectively.

Secondly, we identify the key determinants of investment-shock pricing. Motivated by the contrast between the developed and emerging markets, we explore country characteristics that affect the pricing of investment shocks. Through a series of cross-country regressions, we find that access to capital, access to financial institutions, and product market competition are the three main drivers of investment-shock pricing. Specifically, the negative pricing of investment risk is stronger in countries with greater access to capital, better financial institutions, and higher product market competition. To evaluate the overall impact of the aforementioned characteristics, we introduce a composite index that determines the degree of investment-shock pricing across countries.

Thirdly, we scrutinize the link between the investment effect and the value effect documented in the U.S. market (Anderson and Garcia-Feijóo (2006), Xing (2008)). Since the value effect is prevalent in international markets as well, our cross-country setting offers a natural laboratory to address this issue. We find that the investment effect is associated with, but not subsumed in, the global value effect. The relation between negative investment pricing and its three key determinants is robust to controlling for the value premium. Taken together, our results underscore the role that the three country characteristics play in the pricing of risk inherent in investment-specific technological innovations.

The importance of real investment for economic growth has been extensively documented in macroeconomic literature. Investment-specific technological shocks have been found to account for the majority of long-run growth in output and investment opportunities (see, for e.g., Solow (1960), Hulten (1992), Greenwood, Hercowitz, and Krusell (2000), and Cummins and Violante (2002)). Greenwood, Hercowitz, and Krusell (1997) use quality-adjusted price of capital goods as a proxy for investment shocks and find that such innovation explains approximately 60% of the U.S. long-run growth. Fisher (2006) shows that investment shocks, along with neutral technological shocks account for the majority of production and employment variations in the U.S.[2] Justiniano, Primiceri, and Tambalotti (2011) further claim that investment shocks are the most important source of the U.S. business cycle fluctuations. All such evidence suggests that investment shocks have a material consequence on aggregate welfare.

Our study builds on the macro-finance literature that takes the resulting pricing implications seriously. The theoretical disagreement mentioned above reflects the different views on how investment shocks affect household welfare. Connecting to the production-based asset pricing literature (Cochrane (1996)), Papanikolaou (2011) shows that households' marginal utility rises as the economy reallocates resources away from the production of consumption goods toward investment goods, if the households have preference toward later resolution of uncertainty, or more specifically, sufficiently low risk aversion and low elasticity of in-

[2] Neutral technological shocks are technological innovations that affect the production of all goods.

tertemporal substitution. Intuitively, such investors are more concerned about smoothing consumption over time than across states. They would prefer assets that do well when investment sacrifices current consumption for improved future consumption. Such assets require low expected returns to clear their markets, leading to a negative premium on investment shocks. Kogan, Papanikolaou, and Stoffman (2017) further show that investment shocks reduce household's indirect utility, in the case of incomplete markets for new ideas, where innovators capture only a fraction of the economic rents. The benefits from capital embodied innovation accrue to a small fraction, whereas the cost of creative destruction has an impact on a larger fraction of the population, thus creating a reallocative effect.[3]

It is possible to mitigate or even reverse the trade-off between investment and consumption. Garlappi and Song (2016*b*) theoretically show that consumption can increase, rather than decrease, upon a positive investment shock if firms can optimally increase their capital utilization. Backing out latent factors from a dynamic stochastic general equilibrium model, Li, Li, and Yu, (2017) estimate a reliably positive premium for investment-specific technology shocks. They provide optimal capital utilization as a potential explanation for their finding. Our study offers another piece of evidence for positive pricing from a development perspective.

The rest of the paper is organized as follows. Section 2 discusses data and methodology, and quantifies global investment-shock premiums in both time series and the cross section. Section 3 explores the determinants of pricing via a cross-country analysis, and demonstrates their robustness against the value effect. The last section concludes.

[3]Under this framework, the negative premium is not conditional on households having preference for late resolution of uncertainty.

2 Pricing of Investment Shocks in International Markets

2.1 Data and Methodology

The variable of our interest is the return on the mimicking portfolio of investment-specific technological shocks. Following Gomes, Kogan, and Yogo (2009) and Papanikolaou (2011), we classify industries into investment- and consumption-good producers based on the input-output tables for each country. The details are reported in Appendix A.1. We choose this methodology given that all the necessary data for construction are available for a wide range of countries. We exclude financial and utility firms and require a country to have at least three consumption good producers and three investment good producers among firms in the national market.

At the end of each June, the mimicking portfolio goes long investment good producers and short consumption good producers within each country. Each side of the positions is value weighted, and returns are measured monthly from July to next June. The mimicking portfolio return is given by the spread between the returns on investment and consumption good producers, and hence dubbed the investment-minus-consumption (IMC) factor.

The data on stock market variables, such as the return index and market capitalization, are obtained from Thomson-Reuters Datastream. We supplement this data by Worldscope to collect accounting information and industry classification codes. To ensure the quality of the return data, we apply the screening proposed by Ince and Porter (2006) and treat returns above 300% that are reversed within one month as missing.[4] Following McLean, Pontiff, and Watanabe (2009) and Watanabe, Xu, Yao, and Yu (2013), we also winsorize

[4]Specifically, if r_t and r_{t-1} are the returns in months t and $t-1$, respectively, we set both to missing if either is greater than 300% and $(1+r_t)(1+r_{t-1})-1 < 50\%$.

all the Datastream and Worldscope variables at the top and bottom one percentiles of their distributions within each country to eliminate the effect of outliers. For accuracy, we only use years in which a country has at least 50 stocks available.

Table 1 reports the descriptive statistics of our data. The sample covers 33 countries and spans varying periods between July 1982 and June 2014. In all countries but two (Denmark and Sweden), there are more consumption good producers (#Cons) than investment good producers (#Inv), resulting in the ratio of the number of firms in the former category to the latter larger than 1. The real investment (INV) and real gross domestic product (GDP) per capita also show a large dispersion across countries, indicating economic heterogeneity.

2.2 Characteristics of Investment-shock Factor

As a preliminary examination of the investment-shock factor, IMC, Table 2 reports the correlation between IMC and the excess returns on the market portfolio (MKT), value (HML), and size (SMB) factors measured in local currency at the country level. MKT is the return on the country total return index from Datastream. SMB and HML are the size and value factors, respectively, constructed similarly to Fama and French (1993) by two-way independent sorts of individual stocks on market capitalization and the book-to-market ratio at the end of each June.

Out of the 33 countries, 21 have positive correlations between IMC and MKT ("$\# > 0$"), 15 of which are significant at the 10% level ("$\# > 0$, signif."). In contrast, of the remaining 12 countries with negative correlations ("$\# < 0$"), only 5 exhibit significantly negative ones ("$\# < 0$, signif."). Although much smaller in magnitude, the correlation between IMC and HML is negative for the U.S., consistent with Kogan and Papanikolaou

(2014). However, this is not the case for majority of the markets. We find that 20 countries have positive correlations between IMC and HML, of which 11 are significant. Only 9 of the remaining 13 countries exhibit a significantly negative correlation. The connection between value factor and investment shocks seems more complex in international markets. We will return to this point in Section 3.3 where we investigate the relation between the investment and value effects. Finally, 26 countries have positive correlations between IMC and SMB, of which 16 are significant, while only 1 of the remaining 7 countries exhibit a significantly negative correlation.

To examine the appropriateness of using the IMC portfolio returns as a proxy for investment shocks, we examine its macroeconomic dynamics. Specifically, we examine the dynamic change in per capita real investment and real output in response to a positive shock to the IMC factor. Using a panel regression, we estimate

$$\frac{1}{1+k}(x_{i,t+k} - x_{i,t-1}) = \alpha_0 + \beta_k R_{i,t}^{imc} + \gamma \Gamma_{i,t} + \epsilon_{i,t+k}, \qquad k = 0, \ldots, K, \tag{1}$$

where i denotes the country, x denotes the log value of the predicted variable, $R_{imc,t}$ denotes the return spread between investment and consumption good producers, and Γ is a vector of controls, which includes the lag value of log x. We estimate the local projections for the pooled sample of developed countries and emerging markets for up to $K = 20$ quarters ahead. We use a quarterly frequency for greater accuracy. The standard errors are corrected for heteroscedasticity and serial correlation using the Newey and West (1987) procedure. Figures 1 and 2 depict the results. The increase in real investment validates the use of IMC portfolio as a proxy for investment shocks. While investment increases for both panels, the response is much larger in magnitude for developed countries.

If an investment shock has smaller increase the output in the short term, this likely entails an offsetting decrease in other components of the GDP. If it sacrifices consumption rather than government spending or net export (neither of which is modeled in any of the papers reviewed in the introduction), the environment is consistent with Papanikolaou (2011) and Kogan, Papanikolaou, and Stoffman (2017) model assumptions. Otherwise, a competing story such as optimal capital utilization (Garlappi and Song (2016*b*)) and other unmodeled mechanisms would become relevant. Figure 2 show that the increase in output in emerging markets is much larger in magnitude relative to developed markets, hence it is more likely that a reallocation effect occur in developed countries.

2.3 Country-Level Pricing of Investment-shock Factor

This section examines the pricing of the investment-specific technology shocks proxied by the IMC factor. We use two measures of risk premium within each country. The first measure, TSP, is the time-series mean of the monthly return spread between two extreme IMC-beta sorted portfolios. At the end of each June, we sort stocks into portfolios based on their IMC betas estimated from weekly returns over the past 12 months. To ensure that each portfolio is well diversified, we form decile portfolios for the three largest markets (the U.S., Japan, and UK), tercile portfolios for nine small countries (Argentina, Austria, Belgium, Brazil, China, Chile, Denmark, Indonesia, Mexico, Malaysia, Netherlands, Norway, Peru, Poland, Portugal, Spain, and Turkey), and quintile portfolios for the remaining countries. We compute the value-weighted returns on the zero-investment portfolio long the highest IMC beta portfolio and short the lowest IMC beta portfolio for the following

12 months. TSP is then the mean return of this long-short portfolio.

The second measure, CSP, is the cross-sectional premium on the IMC factor, estimated by the one-step GMM procedure as described in Cochrane (2005). The moment conditions for each country simultaneously include the orthogonality conditions for the time-series regressions of each IMC beta portfolio return on a constant, IMC, and the market return, as well as the orthogonality conditions for the cross-sectional regression of the portfolio returns on the two factor loadings restricting the intercept to be zero.

Table 3 summarizes the two premium estimates in percentage, in both local and U.S. currencies. We find that 22 out of the 33 countries have negative TSP in the local currency, and 23 countries do in U.S. dollar returns. The conventional level of significance (two-sided $p < 10\%$) at the relevant degrees of freedom is approximately $|t| > 1.65$. Of those negative estimates, seven are significant by that standard in the local currency (Austria, Australia, Belgium, Canada, Germany, Netherlands, and the U.K.), and six are significant in U.S. dollars (Austria, Australia, Canada, Germany, Hong Kong, Netherlands, and Portugal).

The cross-sectional premium largely echoes the message from its time-series counterpart. In local currency returns, 23 countries exhibit negative CSP, of which eleven are significant, comprising of developed and emerging countries (Austria, Australia, Canada, France, Germany, Mexico, Netherlands, Porland, South Korea, Switzerland, and the U.K).[5] The qualitative result on CSP barely changes upon U.S. currency conversion.

The U.S. premium is negative but insignificant throughout the table, regardless of the estimation method. While the time-series premium is also negative and insignificant in

[5]Following the International Finance Corporation, here we classify South Korea as well as Hong Kong and Taiwan as developed markets. The IFC developed-country dummy, $DIFC$, to be introduced below, for these countries and regions takes the value of 1.

Papanikolaou (2011), he does find a significantly negative cross-sectional premium by an expansion of the stochastic discount factor. It is possible that the difference arises from his use of the CRSP data, which is longer and more comprehensive in the coverage of U.S. stocks.

Overall, we find a spectrum of investment-shock premiums ranging from being significantly negative to positive across international markets, with more prevalence on the negative side. Importantly, significantly negative estimates tend to arise in developed countries, while positive ones in merging markets. This appears to suggest that an economy can exhibit a positive investment-shock premium in its early stage, which turns negative as it matures. This hypothesis potentially reconciles the conflicting evidence on the sign of investment-shock premium in the U.S. market; Papanikolaou (2011), Kogan and Papanikolaou (2014), and Kogan and Papanikolaou (2013) estimate negative premiums using the sample from 1963, while Garlappi and Song (2016*b*) find positive premiums in extended periods covering as early as the 1930's, in which the less mature U.S. economy suffered from the Great Depression. We now turn to a formal analysis of this point by seeking the determinants of investment-shock premium in the cross section of countries rather than over different sample periods within a country.

3 Cross-country Analysis

3.1 Hypothesis Development

The last section finds a large cross-country dispersion in the extent of investment shock pricing. We now explore potential determinants of such differences. We consider four types of country characteristics as potential drivers of the investment effect.

First, we explore whether the investment-shock pricing differs between developed and emerging markets. Tinn (2010) finds that high uncertainty discourages firms from adopting new technologies. Acemoglu (2002) argues that a lack of skilled labor causes delay in technological adoption. Further, Kortum and Lerner (2000) find that venture capital is the major source of funding for technology firms. Taken together, we conjecture that investment shocks are a stronger determinant of asset prices in developed countries with lower political uncertainty and more abundant skilled labor.

To test this hypothesis, we use two country-level dummy variables for economic development. $DIFC$ and $DDJI$ take the value of one if a country or region is classified as developed by the International Finance Corporation and the Dow Jones Indexes (DJI) country-classification system, respectively, and zero otherwise. The developed markets are more accessible to and supportive of foreign investors, whereas emerging markets (and frontier markets in the DJI country-classification system) are less accessible and support a smaller investment landscape. The DJI country classification is based on analysts' examination of market and regulatory structure, trading environment, and operational efficiency of each country.

The second type of country characteristics proxies for access to capital and efficiency in capital allocation. The first measure of access to capital is simply the aforementioned average real investment per capita (INV, see Table 1) for each country. The second measure is the investment-to-capital ratio (IK); Kogan and Papanikolaou (2013) show that firms with higher IK experience greater exposures to the IMC factor. Such firms also exhibit larger output growth in response to positive IMC shocks. The average INV and IK are ex-post measures of access to capital. The third and fourth measures employ the novel dataset on capital control restrictions on inflows and outflows developed by Fernández, Klein, Rebucci, Schindler, and Uribe (2016) using the IMF's *Annual Report on Exchange Arrangements and Exchange Restrictions*. The capital control restrictions on inflows (KAI) are constructed using ten dimensions in inflow restrictions on equities, bonds, money markets, collective investments, derivatives, commercial credits, financial credits, guarantees/sureties/financial backup facilities, direct investment, and real estate. The capital control restrictions on outflows (KAO) are constructed using the outflow restrictions on the same ten dimensions as KAI. The fifth measure is the efficiency of capital allocation, measured by the elasticity of industry investment to value added (EIV) as in Wurgler (2000).[6] Countries with greater allocative efficiency increase investment more in their growing industries and decrease investment more in their declining industries. Such countries should experience a greater increase in future output and consumption. Building on these results, we propose that the pricing of investment shocks should be stronger (i.e., its premium will be more negative) in countries where firms have higher INV, IK, and EIV as well as lower KAI and KAO on average.

The third type of country characteristics represents the access to financial markets and institutions. Developed financial markets provide a key role in allocating capital to productive investments, monitoring such investments, and diversifying risk (Levine (2005)). Earlier work uses simple ratios, such as private credit over GDP and stock market capitalization over GDP, to measure financial development (see, for e.g., LaPorta, Lopez de Silanes, Shleifer, and Vishny (1997) and Rajan and Zingales (1998)). Extending the idea to capture

[6] The data is from Jeffrey Wurgler's website.

the increasing complexity in financial development, we employ multidimensional indexes proposed by Sahay et. al. (2015) and Svirydzenka (2016). Designed to gauge the depth of financial markets and institutions as well as access to them, the indexes are constructed from a number of data sources including the World Bank FinStats, the IMS's *Financial Access Survey*, the Dealogic corporate debt database, and the Bank for International Settlement (BIS) debt securities database. The first measure is the financial institutions depth (FID), which is a weighted index of the ratios of private-sector credit to GDP, pension fund assets to GDP, mutual fund assets to GDP, and insurance premiums to GDP. The second measure is the financial institutions access (FIA), a weighted index of the number of bank branches per 100,000 adults and ATMs per 100,000 adults. The third measure, the financial markets depth (FMD), is a weighted index of the ratios of stock market capitalization to GDP, stocks traded to GDP, international debt securities of the government to GDP, total debt securities of financial corporations to GDP, and total debt securities of non-financial corporations to GDP. The final measure is the financial markets access (FMA), a weighted index based on the percent of market capitalization excluding the ten largest companies and the total number of debt issuers. We expect that the pricing of investment shocks will be stronger in countries with higher FID, FIA, FMD, and FMA.

The fourth and last type of country characteristics captures competition in product markets and industries. Following the norm in the industrial organization literature, we use the industry net profit margin (NPM, the annual average operating income before depreciation and amortization divided by sales) as a measure of firms' market power and hence an inverse measure of competition. It is commonly used as the empirical proxy for the Lerner index, which represents firms' ability to set prices above marginal cost. Another measure of competition is import penetration ($IMPP$) downloaded from the OECD database. It gauges the extent to which domestic demand is met by imports, i.e., the degree of import competition. $IMPP$ tends to be low for big economies such as the U.S. and Japan, while geographic reasons also make it low for countries like Australia and New Zealand. Therefore, high values of $IMPP$ are shared by both small, emerging economies and developed, integrated European countries, giving it a separate role from correlated economic-development proxies such as KAI and FID.

Finally, to capture the overall effect, we construct a composite index of the above three non-dummy types of country characteristics. We choose about a half of variables, which are both strong determinants of investment premium and time varying, from each characteristic type: IK and KAI from the second type, FID and FIA from the third type, and NPM from the last type. Each year, we sort countries by IK, FID, and FIA and assign the highest rank to those with the highest characteristic values. Similarly, we sort countries by KAI and NPM every year and those with the lowest characteristic values receive the highest rank. A country's composite index for the degree of IST-shock pricing, $ISTI$, is then the time-series mean of its annual average rank over the five characteristics. We conjecture that the pricing of investment shocks will be stronger in countries with the higher values of $ISTI$.

Table 4 presents pairwise correlations between the country characteristics. As expected, the two development country dummy variables are strongly correlated with EIV, FID, FMD, and INV at a level of 0.6 or higher. In particular, the highest correlation in the table, 0.825, is observed between INV and $DIFC$. A closer look reveals that all pairwise correlations between these four characteristics are no less than 0.5. Therefore, firms in developed countries tend to have greater depth in financial markets and institutions, and make more investments with greater allocative efficiency. As an inverse measure of competition, NPM is strongly negatively correlated with all of these variables. Likewise we observe negative correlations between KAI or KAO and all the other variables except for NPM, implying that more developed, accessible, and efficient countries tend to have less restrictions on capital inflows and outflows.

3.2 Determinants of Investment-shock Pricing

We are now ready to identify the country attributes that affect the pricing of investment shocks. We regress the value-weighted time-series or cross-sectional premium (TSP or CSP) in the local currency on a set of country characteristics proposed in the previous section. We focus on the value-weighted premium measures for brevity, as the result for equally weighted measures are similar. Since some of the characteristics are highly correlated, putting all of them together in one specification to explain a small cross section of 33 countries will cause a severe multi-collinearity problem. Therefore, we will examine several variables belonging to an economic category at a time to refine variables and reach a grand final model using our proposed composite IST-pricing index, $ISTI$.

Tables 5 and 6 report our main results for TSP and CSP, respectively. Panel A in each table examines the proxies for economic development. Consistent with our first hypothesis, Column 1 in Panel A of Table 5 shows that developed countries exhibit significantly lower investment-shock premiums than emerging markets: The coefficients on $DIFC$ and $DDJI$ imply that TSP is lower, or more negative, by 0.440% and 0.568%, respectively, per month in developed countries than in emerging/frontier markets. This difference is both economically and statistically significant. In contrast, TSP in emerging/frontier markets, which equals the intercept, is insignificant in both specifications.

Turning to the role of access to capital and capital allocation in Panel B, we find that all the proxies are statistically significant. The results are in accordance with the conjecture in the previous section: Countries with higher average real investment per capita (INV) and the investment-to-capital ratio (IK), both ex-post measures of access to capital, have significantly lower investment-shock premiums. Columns 3 and 4 show that greater capital control restrictions on inflows (KAI) and outflows (KAO) increase the investment shock premium, or make it less negative. The capital control restrictions on inflows explain approximately 35% (the adjusted $R^2 = 0.35$) of the variation in the investment shock premiums across countries. We also find that countries with higher efficiency of capital allocation (EIV) carry a significantly lower TSP as evidenced in Column 5.

Panel C shows that financial development plays a significant role in the pricing of investment shocks. All specifications show negative coefficients, implying that countries with greater financial development have lower investment-shock risk premiums. Of those proxies, the financial institutions access (FIA) alone garners an explanatory power of as large as 25%.

Panel D reports that both the measures of competition significantly explain the TSP and CSP, respectively. The result implies that countries with higher average industry net profit margin (NPM), an inverse measure of competition, exhibit a larger, or less negative, investment-shock premium. We also find that high values of $IMPP$ are associated with a lower investment-shock premium.

Panel E shows that $ISTI$, which captures the overall effect of access to capital, efficiency of financial markets, and competition in product markets and industries on the investment-shock effect, is associated with a significantly lower investment-shock premium. Moreover, it explains a large fraction of cross-country dispersion in the investment shock premiums: 26%. $ISTI$ remains significant when controlled for KAI, FIA, and $IMPP$.

The result using the cross-sectional premium (CSP) in Table 6 is similar in that all the characteristic are significant with the same expected signs. The adjusted R^2 is sometimes, but not always, smaller perhaps reflecting the noisiness of the estimates as we have seen in Table 3.

Figure 3 plots TSP against selected variables ($DDJI$, KAI, FIA, and INV) for visual inspection. Panel A confirms that TSP is generally lower, and mostly negative indeed, in developed countries than emerging markets as classified by $DDJI$. Panel B clearly depicts the positive relation between TSP and KAI, while the remaining two panels do the negative relation between TSP and FIA or INV. These three panels are annotated by the country codes of selected countries in Table 1. The contrast between the clusters of developed and emerging/frontier markets is striking.

Overall, our analysis suggests that access to capital, financial development and product market competition are the three key determinants of the cross-country differences in the pricing of investment-specific technology shocks proxied by the IMC factor. We further examine the importance of these characteristics in explaining the association between the sensitivity to investment shocks and the subsequent returns by examining firm level data. We construct a panel of firm level returns, in local currency, and their exposures to local investment shocks, by combining data from all 33 countries. In order to measure the overall efficiency in terms of the three characteristics of interest, we employ the newly introduced

$ISTI$ measure. We conduct the following panel regression:

$$Ret_{i,t+1} = \alpha_i + \delta_t + \gamma_1\, \beta_{i,t}^{IMC} + \gamma_2\, ISTI_{C,t} + \gamma_3\, (ISTI_{C,t} * \beta_{i,t}^{IMC}) + \epsilon_{i,t+1}, \qquad (2)$$

where $Ret_{i,t+1}$ stands for the yearly stock return of firm i at time $t+1$, α_i are firm fixed effects, δ_t are year fixed effects, $\beta_{i,t}^{IMC}$ represents the exposure to the local IMC shock at time t, $ISTI_{C,t}$ is the country level investment-shock pricing measure and ϵ_i is an error term. Our hypothesis is that firms with higher exposure to investment shocks will have relatively lower future returns in countries with higher $ISTI$. If our conjecture is correct, we must find that the coefficient estimate for the interaction between $\beta_{i,t}^{IMC}$ and $ISTI_{C,t}$ is negative.

Table 8 presents the results from the panel regression. Columns (I) and (II) show that both γ_1 and γ_2 are not significant. Column (III) presents the results for the full specification. Consistent with our conjecture, the results show that the interaction term between $\beta_{i,t}^{IMC}$ and $ISTI_{C,t}$, γ_3 , is negative and significant. This provides conclusive evidence that that firms with higher exposure to investment shocks tend to have relatively lower subsequent returns in countries with greater investment-shock pricing as approximated by $ISTI$.

Given the challenging nature of interpreting the interaction term, we graphically show the predictions of the model for the case in which $ISTI = 10$ (i.e., countries with lower efficiency in terms of access to capital, access to financial institutions, and competition in product markets) and $ISTI = 26$ (i.e., countries with higher efficiency in terms of access to capital, access to financial institutions, and competition in product markets). Figure **??** presents the response of stock returns to different sensitivities to the investment shock, at both values of $ISTI$. The left panel shows a positive association between β^{IMC} and subsequent stock returns for the low value of $ISTI$, whereas the right panel shows a negative association between the β^{IMC} and the subsequent stock return for the high value of $ISTI$. The results clearly indicate that firms with higher exposure to investment shocks will have relatively lower subsequent returns in countries with higher $ISTI$, ceteris paribus.

3.3 Value and Investment Effects

Existing studies using U.S. data find that a substantial part of the value premium can be explained by investment (Xing (2008)). We also know that the value effect is prevalent as well in international markets, which clearly differ in the levels of access to capital, financial development, and product market competition. Thus, international markets offer a natural laboratory to reexamine the link between investment and valueness of firms.

To address this question, we first whiten the investment-shock premium against the value premium. Since the results for TSP and CSP in the previous section were similar, we focus on the former for brevity. We regress TSP on HML with an intercept for each country. We then substitute the estimated intercept, denoted as $TSPC$ (suffix "C " for "Controlled"), for the dependent variable in the cross-country regressions in the previous section. Table 7 reports the result. There is indeed some sign that the value effect is linked to the investment effect in international markets; the coefficients on some variables are noticeably reduced in magnitude, and FID and FMD lose statistical significance. However, all the other variables remain significant both statistically and economically with the expected signs. For example, according to Column 2 of Panel A, the average $TSPC$ in emerging markets is only 0.079%, which will be reduced by 0.45% in developed markets. The

0.45% reduction is still significant ($t = -2.49$) and economically nontrivial. More robustly, KAI, FIA, and NPM carry significant coefficients with t-statistics of 3.03, -2.41, and 2.23, respectively, in their univariate specifications. Our composite index for IST-shock pricing, $ISTI$, remains significant with a t-statistic of -2.56 in Panel E.

Figure 4 plots $TSPC$ against the same four characteristics ($DDJI$, KAI, FIA, and NPM) as Figure 3. While the slopes are reduced in magnitude from those in Figure 3, the strong relations between $TSPC$ and the four variables clearly remain.

Figure 5 plots TSP and $TSPC$ against the composite index ($ISTI$) side-by-side for comparison. The left panel shows a strong negative relation between TSP and $ISTI$. Many of the emerging countries such as China, India, and Mexico exhibit lower $ISTI$ and higher, more positive investment-shock premiums and cluster in the top left region of the panel. In contrast, most of the developed nations such as Canada, Switzerland and the U.K. exhibit higher $ISTI$ and strong negative investment-shock premiums, placing themselves in the bottom right region of the panel. The right panel in Figure 5 continues to present a strong negative association between $TSPC$ and $ISTI$ despite some minor reduction in the slope. The important take-away is that the relative positions of the countries are generally unchanged by cleansing the value premium from the investment-shock premium.

To summarize, the investment effect appears to be associated with, but remains robust to, the value effect in international markets. This highlights the role that access to capital, financial institutions development, and product market competition play in efficient capital allocation, and the resulting pricing of investment-specific technological shocks.

4 Conclusions

Investment-specific technological innovations are a critical driver of long-run economic growth. Recent studies take this well-documented fact seriously and cast the mechanism in general equilibrium to deliver sharp conclusions. Despite such serious efforts, they have reached opposite conclusions both theoretically and empirically. To shed light on the potential causes of the disagreement, we take this study to a hitherto unexplored direction by employing a large panel of firms from 33 international markets.

We make three major contributions. First, we show that investment shock premiums vary in sign and magnitude across markets. The pricing tends to be negative and often significant in developed markets, while it is weakly positive in emerging markets. Second, we identify three key determinants of such cross-country dispersions. Countries with greater access to capital, better financial institutions and higher product market competition exhibit negative and larger prices of investment risk. Finally, the value effect reduces, but does not subsume, the cross-country difference in the investment effect. Our analysis adds to the growing literature on production-based asset pricing by illustrating that investment-specific technology innovations are a relevant risk factor in international markets.

A Appendix

A.1 Classification of Investment- and Consumption-good Industries

The procedure used to map investment and consumption firms is similar to that of Gomes, Kogan, and Yogo (2009) and Papanikolaou (2011). Table A1 presents the sources used to gather input-output tables for each country. We classify industries based on the sector to which they contribute the most value in terms of purchaser's prices. Specifically, we identify how much output each industry contributes to the four broad categories of final demand: private consumption, gross private investment, government expenditures and net exports of goods and services.

The industry classification system differs across countries depending on the original source of data. Industries are reported in the United Nations ISIC (International Standard Industrial Classification) classifications for Australia, Brazil, Canada, Chile, China, Greece, Hong Kong, India, Indonesia, Japan, Mexico, Peru, South Africa, South Korea, Switzerland, Taiwan and Turkey. Industries are reported in the NACE (Statistical classification of economic activities in the European Community) classifications for Austria, Belgium, Denmark, France, Germany, Italy, Malaysia, Netherlands, Norway, Sweden and U.K. Industries in the United States are classified according to the NAICS (North American Industry Classification System) classification system. We map each ISIC, NACE and NAICS industry with the corresponding four-digit SIC industry from Datastream. The appropriate conversion tables are available from the Eurostat, the United Nations Statistical Division and the United States Census Bureau websites.

References

Acemoglu, Daron, 2002, "Directed Technical Change." *Review of Economic Studies* 69(4), 781–809.

Anderson, Christopher W., and Luis Garcia-Feijóo. 2006. "Empirical Evidence on Capital Investment, Growth Options, and Security Returns." *Journal of Finance* 61, no. 1: 171-94.

Cochrane, John H. 1996. "A Cross-Sectional Test of an Investment-Based Asset Pricing Model." *Journal of Political Economy* 104 (June), 572–621.

Cochrane, John H. 2005. Asset Pricing (revised ed.), Princeton University Press, Princeton, NJ.

Cummins, J. G., and G. L. Violante. 2002. "Investment-specific Technical Change in the U.S. (1947–2000): Measurement and Macroeconomic Consequences." *Review of Economic Dynamics* 5, 243–284.

Fama, Eugene F., and Kenneth R. French. 1993. "Common Risk Factors in the Returns on Stocks and Bonds." *Journal Financial Economics*. 33: 3–56.

Fernandez, Andres, Klein, Michael W., Rebucci, Alessandro, Schindler, Martin, and Martin Uribe. 2016. "Capital Control Measures: A New Dataset." *IMF Economic Review* 64, 2016, 548-574.

Fisher, Jonas D. M. 2006. "The Dynamic Effects of Neutral and Investment-Specific Technology Shocks." *Journal of Political Economy* 114 (June), 413–51.

Garlappi, Lorenzo, and Zhongzhi Song, 2016, "Can Investment Shocks Explain the Cross-Section of Equity Returns?", *Management Science*, Forthcoming.

Garlappi, Lorenzo and Zhongzhi Song. 2016. "Capital Utilization, Market Power, and the Pricing of Investment Shocks", *Journal of Financial Economics*, Forthcoming.

Gomes, Joao F., Leonid Kogan, and Motohiro Yogo. 2009. "Durability of Output and Expected Stock Returns." *Journal of Political Economy,* 117 (5), 941–986.

Greenwood, Jeremy, Zvi Hercowitz, and Per Krusell. 1997. "Long-Run Implications of Investment-Specific Technological Change." *American Economic Review* 87 (June), 342–362.

Greenwood, Jeremy, Zvi Hercowitz, and Per Krusell. 2000. "The Role of Investment-Specific Technological Change in the Business Cycle." *European Economic Review* 44, 91–115.

Hulten, Charles R. 1992. "Growth Accounting when Technical Change Is Embodied in Capital." *American Economic Review* 82, 964–980.

Ince, Ozgur. S. and R. Burt Porter. 2006. "Individual equity return data from Thomson Datastream: handle with care!." *Journal of Financial Research* 29, 463–479.

Justiniano, Alejandro, Giorgio E. Primiceri, and Andrea Tambalotti. 2011. "Investment Shocks and the Relative Price of Investment." *Review of Economic Dynamics* 14: 101–21.

Kogan, Leonid, and Dimitris Papanikolaou. 2013. "Firm Characteristics and Stock Returns: The Role of Investment-Specific Shocks." *Review of Financial Studies*, 26 (11): 2718-2759.

Kogan, Leonid, and Dimitris Papanikolaou. 2014. "Growth Opportunities, Technology Shocks, and Asset Prices." *Journal of Finance*, 69, 675-718.

Kogan, Leonid, Dimitris Papanikolaou, and Noah Stoffman, 2017, "Winners and Losers: Creative Destruction and the Stock Market," *Working paper*.

Kortum, Samuel, and Josh Lerner. 2000. "Assessing the Contribution of Venture Capital to Innovation." *RAND Journal of Economics* 31 (4), 674–92.

LaPorta, R., F. Lopez-de-Silanes, A. Shleifer, and R. W. Vishny. 1997. "Legal Determinants of External Finance." *Journal of Finance* 52, 1131–1150.

Levine, Ross. 2005. "Finance and Growth: Theory and Evidence." Handbook of Economic Growth, in: Philippe Aghion and Steven Durlauf (ed.), *Handbook of Economic Growth*, edition 1, volume 1, chapter 12, pages 865-934 Elsevier.

Li, Erica X. N., Haitao Li, and Cindy Yu. 2017. "Macroeconomic Risks and Asset Pricing: Evidence from a Dynamic Stochastic General Equilibrium Model." *Working paper*.

McLean, R. D., J. Pontiff, and A. Watanabe. 2009. "Share Issuance and Cross-sectional Returns: International Evidence." *Journal of Financial Economics* 94, 1–17.

Newey, W. K., and K. D. West, 1987. "A Simple, Positive Semi-definite, Heteroskedasticity and Auto Correlation Consistent Covariance Matrix." *Econometrica* 55, 703-708.

Papanikolaou, Dimitris. 2011, "Investment Shocks and Asset Prices," *Journal of Political Economy* 119 (4), 639 685.

Rajan, Raghuram G. and Luigi Zingales. 1998. "Financial Dependence and Growth." *American Economic Review*, 88: 559-586.

Sahay, Ratna, Martin Cihák, Papa N'Diaye, Adolfo Barajas, Ran Bi, Diana Ayala, Yuan Gao, Annette Kyobe, Lam Nguyen, Christian Saborowski, Katsiaryna Svirydzenka, and Seyed Reza Yousefi. 2015. "Rethinking Financial Deepening: Stability and Growth in Emerging Markets." IMF Staff Discussion Note 15/08. Washington: International Monetary Fund.

Solow, Robert M. 1960. Investment and Technological Progress in Mathematical Methods in the Social Sciences. Stanford, CA: Stanford Univ. Press.

Svirydzenka, Katsiaryna. 2016, "Introducing a New Broad-based Index of Financial Development." *IMF Working Paper.*

Tinn, Katrin. 2010. "Technology Adoption with Exit in Imperfectly Informed Equity Markets." *American Economic Review* 100 (3), 925–957.

Watanabe, Akiko, Yan Xu, Tong Yao, and Tong Yu. 2013. "The Asset Growth Effect: Insights from International Equity Markets." *Journal of Financial Economics* 108 (2), 529-563.

Wurgler, Jeffrey. 2000. "Financial Markets and the Allocation of Capital." *Journal of Financial Economics* 58, 187-214.

Xing, Yuhang. 2008. "Interpreting the Value Effect Through the Q-Theory: An Empirical Investigation." *Review of Financial Studies* 21 (4), 1767-1795.

Table 1: **Descriptive Statistics**

Country	Code	Start	End	#Firms	#Cons	#Inv	Ratio	INV	GDP
Argentina	AR	1999/07	2014/06	46.6	15.2	5.9	2.6	995.9	5457.3
Australia	AU	1988/07	2014/06	612.9	149.4	52.2	2.9	7359.8	29054.8
Austria	OE	1990/07	2014/06	50.9	13.9	6.0	2.3	7845.2	33350.8
Belgium	BG	1987/07	2014/06	74.8	31.9	10.3	3.1	6697.6	31959.5
Brazil	BR	1994/07	2014/06	261.7	90.3	24.7	3.6	868.1	4497.2
Canada	CN	1982/07	2014/06	436.6	46.8	39.0	1.2	6256.9	31210.3
Chile	CL	1994/07	2014/06	101.6	34.5	7.9	4.3	1182.3	6094.5
China	CH	1994/07	2014/06	794.7	170.2	59.2	2.9	503.3	1279.4
Denmark	DK	1988/07	2014/06	117.0	12.7	14.2	0.9	8173.4	42247.2
France	FR	1988/07	2014/06	486.8	100.0	46.3	2.2	6502.2	30846.3
Germany	BD	1990/07	2014/06	415.7	76.3	36.9	2.1	6464.3	31758.4
Greece	GR	1994/07	2014/06	209.8	117.8	27.9	4.2	3775.6	18242.8
Hong Kong	HK	1989/07	2014/06	429.4	168.5	63.5	2.7	5098.3	21970.5
India	IN	1992/07	2014/06	399.4	176.0	33.3	5.3	162.9	592.2
Indonesia	ID	1993/07	2014/06	164.0	36.1	13.6	2.7	261.6	1089.4
Italy	IT	1987/07	2014/06	185.5	50.9	20.2	2.5	5557.1	28267.7
Japan	JP	1982/07	2014/06	1435.0	295.7	167.9	1.8	7883.2	32213.6
Malaysia	MY	1986/07	2014/06	359.9	41.9	35.3	1.2	1192.2	4490.1
Mexico	MX	1992/07	2014/06	99.7	45.5	9.1	5.0	1420.8	7300.4
Netherlands	NL	1986/07	2014/06	114.0	15.6	12.9	1.2	7345.4	35896.1
Norway	NW	1989/07	2014/06	123.6	25.0	15.8	1.6	11508.2	55767.0
Peru	PE	1998/07	2014/06	94.3	39.1	5.1	7.7	534.9	2600.8
Poland	PO	1999/07	2014/06	138.3	58.9	28.9	2.0	1428.5	7316.2
Portugal	PT	1994/07	2014/06	55.4	26.8	10.6	2.5	3513.8	16000.3
Spain	ES	1989/07	2014/06	78.1	15.7	14.4	1.1	5434.8	21875.2
South Africa	SA	1986/07	2014/06	172.9	55.2	23.0	2.4	856.1	5256.5
South Korea	KO	1993/07	2014/06	743.9	123.0	39.8	3.1	4443.2	13793.4
Sweden	SD	1989/07	2014/06	239.3	20.8	35.3	0.6	8135.9	36563.2
Switzerland	SW	1987/07	2014/06	154.5	39.9	13.7	2.9	12219.8	51084.9
Taiwan	TA	1996/07	2014/06	491.1	47.3	17.3	2.7	4441.2	12689.0
Turkey	TK	1996/07	2014/06	161.8	59.5	10.9	5.5	1217.3	5959.9
U.K.	UK	1982/07	2014/06	951.8	200.4	70.2	2.9	5703.6	33043.4
U.S.	US	1982/07	2014/06	2316.9	1166.8	231.3	5.0	7604.1	37499.6

This table provides summary statistics for the 33 countries from the Datastream-Worldscope sample. Following Gomes, Kogan and Yogo (2009), we classify firms into consumption and investment good producers by classifying industries according to each country's Input-Output tables. "Code" is the Country Code from Datastream/Worldscope. "Start" and "End" show the sample period in yyyy/mm format. #Firms is the average number of firms available per year from Datastream. #Cons and #Inv are the average numbers of consumption and investment good producers, respectively, per year. "Ratio" is the ratio of #Cons to #Inv. INV and GDP are the average yearly real investment and real output per capita, respectively, in US dollars from the Worldbank database.

Table 2: **Correlations between IMC and Stock Return Factors**

	MKT	HML	SMB
Argentina	-0.10	0.34***	0.33***
Australia	0.25***	-0.12**	0.42***
Austria	-0.19***	0.07	0.22***
Belgium	0.08	0.05	0.14**
Brazil	-0.16**	-0.01	0.12*
Canada	0.39***	-0.10*	0.06
Chile	0.16***	0.04	-0.08
China	-0.01	-0.14**	0.23***
Denmark	-0.23***	0.22***	0.38***
France	0.30***	0.03	0.04
Germany	0.09	0.02	0.08
Greece	0.30***	0.17***	0.28***
Hong Kong	0.03	-0.19***	0.36***
India	-0.13**	0.25***	0.00
Indonesia	0.15**	0.31***	0.10
Italy	-0.05	-0.06	0.25***
Japan	0.17***	0.17***	-0.10**
South Korea	-0.04	-0.02	0.10
Malaysia	0.42***	0.35***	0.35***
Mexico	-0.07	0.06	-0.06
Netherlands	-0.32***	-0.12**	-0.01
Norway	-0.07	0.08	0.23***
Peru	0.15**	0.32***	-0.02
Poland	0.19***	0.09	0.24***
Portugal	0.09	0.17**	0.01
Spain	-0.05	0.20***	0.26***
South Africa	0.01	-0.09	0.01
Sweden	0.28***	0.17***	-0.10
Switzerland	0.02	-0.12**	0.08
Taiwan	0.19***	-0.53***	0.03
Turkey	0.21***	0.04	0.07
U.K.	0.15***	-0.11**	0.30***
U.S.	0.38***	-0.21***	0.34***
Average	0.08	0.03	0.13
Avg., Developed	0.07	-0.03	0.16
Avg., Emerging	0.10	0.12	0.10
"# > 0"	21	20	26
"# > 0", signif.	15	11	16
"# < 0"	12	13	7
"# < 0", signif.	5	9	1

This table reports the correlation between the investment-specific technological shocks, proxied by IMC, and each of the market return (MKT), the value factor (HML), and the size factor (SMB), all measured in the local currency. *, **, *** indicate significance at the 10%, 5%, and 1% levels, respectively. The "Average" is across the 33 countries in the sample, and "Avg., Developed" over the 19 developed countries and "Avg., Emerging" over the 14 emerging markets as classified by the International Finance Corporation. "# > 0" and "# < 0" are the number of positive and negative correlations, respectively, of which significant correlations are counted in "# > 0, signif." and "# < 0, signif."

Table 3: **Value-Weighted Investment-shock Premium**

Region	Country	In local currency				In U.S. dollars			
		TSP		*CSP*		*TSP*		*CSP*	
Africa	South Africa	−0.07	(-0.22)	−0.07	(-0.25)	−0.13	(-0.39)	−0.11	(-0.78)
Asia, Developed	Hong Kong	0.00	(-0.01)	−0.19	(-0.42)	−0.02	(-0.05)	−0.16	(-0.31)
	Japan	−0.05	(-0.15)	0.04	(0.17)	−0.13	(-0.38)	0.04	(0.14)
	South Korea	−0.21	(-0.48)	−1.42**	(-2.91)	−0.59	(-1.09)	−2.48**	(-2.03)
	Taiwan	0.27	(0.43)	0.13	(0.24)	0.05	(0.11)	0.16	(0.44)
Asia, Emerging	China	0.18	(0.63)	−0.09	(-0.99)	−0.01	(-0.04)	−0.22**	(-2.17)
	India	0.30	(1.07)	0.05	(0.13)	0.28	(0.97)	0.26	(1.19)
	Indonesia	1.14	(1.60)	0.63	(0.47)	0.79	(1.21)	0.76	(0.66)
	Malaysia	0.12	(0.30)	0.08	(0.12)	0.16	(0.39)	0.09	(0.17)
Australasia, Developed	Australia	−0.95**	(-2.19)	−0.94*	(-1.71)	−0.73*	(-1.71)	−0.79	(-1.53)
Europe, Developed	Austria	−0.83**	(-2.17)	−1.44**	(-3.21)	−0.86**	(-2.40)	−1.60**	(-3.16)
	Belgium	−0.78**	(-2.05)	−0.67	(-1.57)	−0.18	(-0.55)	−0.55	(-1.54)
	Denmark	−0.07	(-0.24)	−0.25	(-0.54)	−0.07	(-0.27)	−0.32	(-0.81)
	France	−0.18	(-0.51)	−0.52**	(-2.48)	−0.11	(-0.34)	−0.38**	(-2.27)
	Germany	−0.92**	(-2.21)	−1.33*	(-1.75)	−0.90**	(-2.21)	−1.19*	(-1.71)
	Italy	−0.11	(-0.27)	−0.65	(-0.67)	−0.02	(-0.07)	−0.33	(-0.98)
	Netherlands	−0.78**	(-2.08)	−0.96**	(-2.15)	−0.82**	(-2.08)	−0.91**	(-2.06)
	Norway	−0.07	(-0.19)	−0.45	(-1.45)	−0.12	(-0.30)	−0.63*	(-1.76)
	Spain	−0.28	(-0.61)	0.03	(0.07)	−0.23	(-0.64)	−0.01	(-0.01)
	Sweden	0.19	(0.56)	−0.16	(-0.39)	0.04	(0.09)	−0.18	(-0.47)
	Switzerland	−0.31	(-1.10)	−0.36**	(-2.78)	−0.33	(-1.18)	−0.56**	(-2.92)
	UK	−0.62*	(-1.77)	−0.78**	(-2.25)	−0.55	(-1.61)	−0.85**	(-2.29)
Europe, Emerging	Greece	−0.49	(-0.68)	−0.14	(-0.26)	−0.05	(-0.09)	0.17	(0.42)
	Poland	0.10	(0.21)	−0.56**	(-2.43)	−0.05	(-0.10)	−0.53**	(-2.32)
	Portugal	−0.43	(-0.49)	−0.77	(-0.85)	−0.82*	(-1.64)	0.04	(0.04)
	Turkey	−0.17	(-0.32)	0.46	(1.06)	−0.13	(-0.23)	0.42	(0.91)
North America, Developed	Canada	−0.72**	(-2.21)	−1.31**	(-2.25)	−0.59*	(-1.69)	−1.03**	(-2.25)
	US	−0.06	(-0.15)	−0.41	(-1.12)	−0.06	(-0.15)	−0.41	(-1.12)
South America, Emerging	Argentina	0.07	(0.09)	−0.58	(-0.58)	0.24	(0.30)	−0.32	(-0.30)
	Brazil	0.23	(0.44)	0.35	(0.36)	0.32	(0.62)	0.49	(0.56)
	Chile	0.77	(1.62)	0.30	(1.32)	0.24	(0.71)	−0.10	(-0.22)
	Mexico	0.15	(0.44)	−0.36**	(-2.03)	0.01	(0.04)	−0.33*	(-1.81)
	Peru	−0.52	(-0.69)	0.66	(1.35)	0.66	(0.83)	1.25	(0.73)

This table reports the premium estimates of the value weighted *IMC* factor. In each June, we sort stocks into deciles based on *IMC* betas within each country. *TSP* is the time-series average of the monthly return spread (in percent) between the highest and lowest *IMC* beta portfolios. *CSP* is the GMM estimate of the cross-sectional premium in percent using the decile portfolios. The sample period is from July 1982 to December 2014. The t-statistics are shown in parentheses, and are based on Newey-West (1987) standard errors with one lag for *TSP*. Statistical significance at the 5%, and 10% levels is indicated by **, and *, respectively.

Table 4: **Correlations between Country Characteristics**

	$DIFC$	$DDJI$	INV	IK	KAI	KAO	EIV	NPM	$IMPP$	FID	FIA	FMD	FMA
$DIFC$	1.000												
$DDJI$	0.741	1.000											
	(0.00)												
INV	0.825	0.719	1.000										
	(0.00)	(0.00)											
IK	0.447	0.472	0.272	1.000									
	(0.01)	(0.01)	(0.16)										
KAI	-0.697	-0.798	-0.720	-0.355	1.000								
	(0.00)	(0.00)	(0.00)	(0.05)									
KAO	-0.725	-0.827	-0.732	-0.252	0.941	1.000							
	(0.00)	(0.00)	(0.00)	(0.16)	(0.00)								
EIV	0.783	0.773	0.626	0.401	-0.822	-0.780	1.000						
	(0.00)	(0.00)	(0.00)	(0.04)	(0.00)	(0.00)							
NPM	-0.575	-0.578	-0.571	-0.344	0.293	0.327	-0.389	1.000					
	(0.00)	(0.00)	(0.00)	(0.05)	(0.10)	(0.07)	(0.05)						
$IMPP$	0.224	0.203	0.135	0.243	-0.228	-0.187	0.120	0.103	1.000				
	(0.30)	(0.36)	(0.54)	(0.26)	(0.30)	(0.39)	(0.61)	(0.64)					
FID	0.728	0.663	0.573	0.329	-0.519	-0.483	0.667	-0.456	0.303	1.000			
	(0.00)	(0.00)	(0.00)	(0.07)	(0.00)	(0.01)	(0.00)	(0.01)	(0.16)				
FIA	0.490	0.676	0.514	0.134	-0.584	-0.568	0.596	-0.429	-0.048	0.503	1.000		
	(0.00)	(0.00)	(0.01)	(0.46)	(0.00)	(0.00)	(0.00)	(0.01)	(0.83)	(0.00)			
FMD	0.730	0.609	0.649	0.267	-0.465	-0.476	0.521	-0.547	0.051	0.854	0.383	1.000	
	(0.00)	(0.00)	(0.00)	(0.14)	(0.01)	(0.01)	(0.01)	(0.00)	(0.82)	(0.00)	(0.03)		
FMA	0.567	0.438	0.613	0.034	-0.426	-0.446	0.374	-0.399	-0.008	0.361	0.247	0.436	1.000
	(0.00)	(0.01)	(0.00)	(0.85)	(0.02)	(0.01)	(0.06)	(0.02)	(0.97)	(0.04)	(0.17)	(0.01)	

This table reports the correlations between country-characteristics. $DIFC$ and $DDJI$ are the developed-country dummy by the IFC and the DJI country-classification system, respectively. $MCAP$ is the proportion of stock market capitalization to the size of overall economy. EIV is the elasticity of industry investment to value added. C/A is the cash-to-assets ratio. Q is Tobin's q, proxied by the market-to-book ratio of assets. IK is the investment-to-capital ratio. INV is real investment per capita. IR is investment responsiveness. NPM is the industry net profit margin $IMPP$ is import penetration. Statistical significance at the 1%, 5%, and 10% levels is indicated by ***, **, and *, respectively.

Table 5: **Country-level Determinants of Time-series Investment-shock Premium**

Panel A: Economic Development

	1		2	
Int	0.099	(0.78)	0.175	(1.55)
$DIFC$	-0.440***	(-2.86)		
$DDJI$			-0.568***	(-4.10)
AdjR^2	0.19		0.34	

Panel B: Access to Capital, Capital Allocation

	1		2		3		4		5	
Int	0.140	(1.08)	0.891**	(2.49)	-0.418***	(-5.30)	-0.392***	(-4.72)	0.471 *	(1.86)
INV	-0.066***	(-2.81)								
IK			-5.241***	(-2.97)						
KAI					0.979***	(4.45)				
KAO							0.736***	(4.74)		
EIV									-1.089 ***	(-3.00)
AdjR^2	0.21		0.14		0.35		0.24		0.26	

Panel C: Financial Development

	1		2		3		4	
Int	0.267	(1.31)	0.281*	(1.74)	0.173	(0.96)	0.191	(0.95)
FID	-0.848**	(-2.43)						
FIA			-0.907***	(-3.36)				
FMD					-0.821**	(-2.33)		
FMA							-0.968**	(-2.07)
AdjR^2	0.15		0.25		0.11		0.07	

Panel D: Competition

	1		2	
Int	-0.675***	(-3.33)	0.044	(0.33)
NPM	6.769**	(2.53)		
$IMPP$			-0.012***	(-3.61)
AdjR^2	0.17		0.08	

Panel E: IST Country Index

	1		2		3		4	
Int	0.517*	(1.93)	0.403	(0.83)	0.565*	(2.06)	0.680**	(2.46)
$ISTI$	-0.043***	(-3.15)	-0.038*	(-1.73)	-0.031*	(-2.04)	-0.038**	(-2.69)
KAI			0.165	(0.32)				
FIA					-0.458	(-1.37)		
$IMPP$							-0.008**	(-2.16)
AdjR^2	0.26		0.23		0.27		0.29	

This table reports the coefficient estimates from cross-country regressions of investment-shock premium on country characteristics. The dependent variables is the value-weighted time-series premium, TSP, measured in the local currency. The independent variables include the followings, along with the intercept (Int): Panel A (Economic development): the developed-country dummy ($DIFC$) by the International Finance Corporation, and the developed-country dummy computed using the Dow Jones Indexes country classification system ($DDJI$); Panel B (Access to Capital, Capital Allocation): thereal investment per capita (INV), the investment-to-capital ratio (IK), the capital control restrictions on inflows (KAI), the capital control restrictions on outflows (KAO), and the elasticity of industry investment to value added (EIV); Panel C (Financial Development): the depth in financial institutions (FID), the access to financial institutions (FIA), the depth in financial markets (FMD), and the access to financial markets (FMA); Panel D (Competition): the industry net profit margin (NPM) and the import penetration ($IMPP$). Panel E (ISTI): the country level composite index for the degree of IST-shock pricing. AdjR^2 is the adjusted R-squared. The t-statistics reported in parentheses are computed using robust standard errors. Statistical significance at the 1%, 5%, and 10% levels is indicated by ***, **, and *, respectively.

Table 6: **Country-level Determinants of Cross-sectional Investment-shock Premium**

Panel A: Economic Development

	1		2	
Int	0.039	(0.33)	0.010	(0.07)
$DIFC$	-0.651***	(-3.99)		
$DDJI$			-0.603***	(-3.35)
AdjR^2	0.30		0.25	

Panel B: Access to Capital, Capital Allocation

	1		2		3		4		5	
Int	0.006	(0.05)	0.930**	(2.34)	-0.537***	(-4.37)	-0.515***	(-4.07)	0.265	(1.18)
INV	-0.081***	(-3.16)								
IK			-6.437***	(-3.24)						
KAI					0.657**	(2.63)				
KAO							0.481**	(2.24)		
EIV									-1.063	***(-3.07)
AdjR^2	0.21		0.14		0.08		0.05		0.15	

Panel C: Financial Development

	1		2		3		4	
Int	0.190	(0.98)	0.059	(0.37)	0.032	(0.16)	0.223	(0.97)
FID	-1.090***	(-3.16)						
FIA			-0.866***	(-2.76)				
FMD					-0.967**	(-2.35)		
FMA							-1.595**	(-2.73)
AdjR^2	0.17		0.14		0.11		0.15	

Panel D: Competition

	1		2	
Int	-0.641***	(-4.37)	-0.138	(-0.67)
NPM	4.979***	(2.79)		
$IMPP$			-0.014**	(-2.32)
AdjR^2	0.31		0.08	

Panel E: IST Country Index

	1		2		3		4	
Int	0.191	(0.54)	1.220**	(2.25)	0.191	(0.53)	0.411	(1.10)
$ISTI$	-0.039**	(-2.31)	-0.081***	(-3.42)	-0.039**	(-2.08)	-0.033*	(-2.01)
KAI			-1.496**	(-2.36)				
FIA					-0.003	(-0.01)		
$IMPP$							-0.011*	(-1.80)
AdjR^2	0.12		0.19		0.07		0.15	

This table reports the coefficient estimates from cross-country regressions of investment-shock premium on country characteristics. The dependent variables is the value-weighted cross-sectional premium, CSP, measured in the local currency. The independent variables include the followings, along with the intercept (Int): Panel A (Economic development): the developed-country dummy ($DIFC$) by the International Finance Corporation, and the developed-country dummy computed using the Dow Jones Indexes country classification system ($DDJI$); Panel B (Access to Capital, Capital Allocation): thereal investment per capita (INV), the investment-to-capital ratio (IK), the capital control restrictions on inflows (KAI), the capital control restrictions on outflows (KAO), and the elasticity of industry investment to value added (EIV); Panel C (Financial Development): the depth in financial institutions (FID), the access to financial institutions (FIA), the depth in financial markets (FMD), and the access to financial markets (FMA); Panel D (Competition): the industry net profit margin (NPM) and the import penetration ($IMPP$). Panel E (ISTI): the country level composite index for the degree of IST-shock pricing. AdjR^2 is the adjusted R-squared. The t-statistics reported in parentheses are computed using robust standard errors. Statistical significance at the 1%, 5%, and 10% levels is indicated by ***, **, and *, respectively.

Table 7: **Country-level Determinants of Time-series Investment-shock Premium Controlling for Value Effect**

Panel A: Economic Development

	1		2	
Int	0.007	(0.05)	0.079	(0.49)
$DIFC$	-0.331*	(-1.78)		
$DDJI$			-0.452**	(-2.49)
AdjR^2	0.07		0.16	

Panel B: Access to Capital, Capital Allocation

	1		2		3		4		5	
Int	0.045	(0.27)	0.676	(1.64)	-0.426***	(-5.00)	-0.380***	(-4.33)	0.321	(0.89)
INV	-0.053*	(-1.91)								
IK			-4.283**	(-2.14)						
KAI					0.875***	(3.03)				
KAO							0.587***	(3.08)		
EIV									-0.893 *	(-1.78)
AdjR^2	0.10		0.06		0.22		0.11		0.14	

Panel C: Financial Development

	1		2		3		4	
Int	0.188	(0.64)	0.206	(0.98)	0.082	(0.34)	0.206	(0.85)
FID	-0.761	(-1.58)						
FIA			-0.826**	(-2.41)				
FMD					-0.683	(-1.48)		
FMA							-1.100*	(-1.96)
AdjR^2	0.09		0.17		0.05		0.08	

Panel D: Competition

	1	
Int	0.253	(0.95)
$ISTI$	-0.031**	(-2.25)
AdjR^2	0.14	

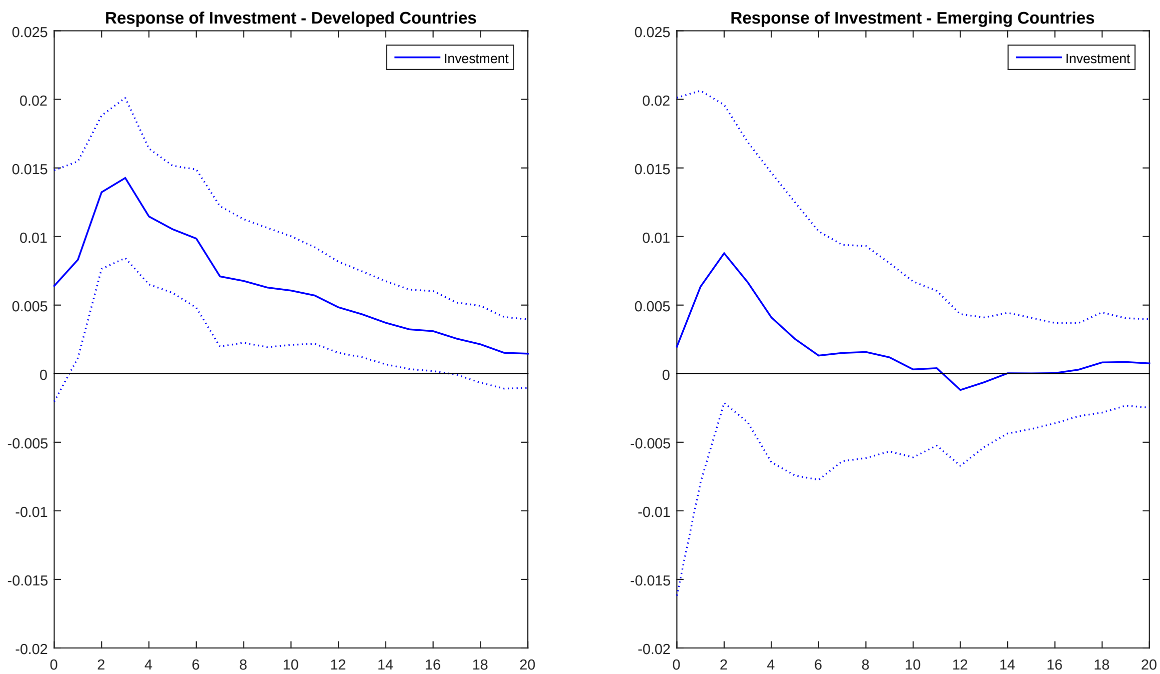
This table reports the coefficient estimates from cross-country regressions of the investment-shock premium, controlled for the value premium, on country characteristics. The dependent variable, $TSPC$, is the intercept from the regression of the value-weighted time-series TSP on the value factor, HML, measured in the local currency within each country. The independent variables include the followings, along with the intercept (Int): Panel A (Economic development): the developed-country dummy ($DIFC$) by the International Finance Corporation, and the developed-country dummy computed using the Dow Jones Indexes country classification system ($DDJI$); Panel B (Access to Capital, Capital Allocation): thereal investment per capita (INV), the investment-to-capital ratio (IK), the capital control restrictions on inflows (KAI), the capital control restrictions on outflows (KAO), and the elasticity of industry investment to value added (EIV); Panel C (Financial Development): the depth in financial institutions (FID), the access to financial institutions (FIA), the depth in financial markets (FMD), and the access to financial markets (FMA); Panel D (Competition): the industry net profit margin (NPM) and the import penetration ($IMPP$). Panel E (ISTI): the country level composite index for the degree of IST-shock pricing. AdjR^2 is the adjusted R-squared. The t-statistics reported in parentheses are computed using robust standard errors. Statistical significance at the 1%, 5%, and 10% levels is indicated by ***, **, and *, respectively.

Table 8: **Firm level exposure to Investment shocks and subsequent stock returns**

	(I)	(II)	(III)
IMC beta(t)	-0.015	-0.015	0.111
	(-0.71)	(-0.73)	(1.41)
ISTI(t)		-0.006	-0.004
		(-0.63)	(-0.41)
IMC beta(t) * ISTI(t)			-0.007**
			(-1.99)
Firm fixed effects	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes
AdjR^2	0.11	0.11	0.11

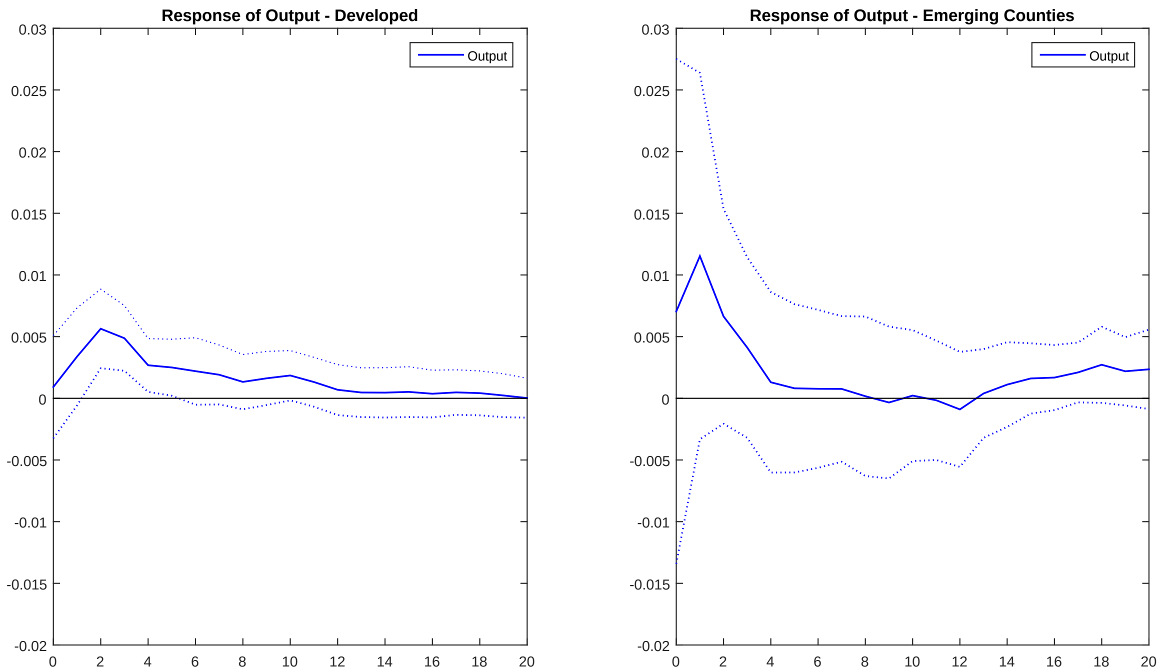
This table reports the average slopes and their time series t-statistics in parentheses from annual panel regressions of individual stock returns in year t+1 on exposure to Investment shocks (IMC beta) and other control variables in year t. The dependent variable is the firm-level stock return in year t+1, measured in the local currency. ISTI is the country level composite index for the degree of IST-shock pricing in year t. AdjR^2 is the adjusted R-squared. The t-statistics reported in parentheses are computed using standard errors clustered by country. Statistical significance at the 1%, 5%, and 10% levels is indicated by ***, **, and *, respectively.

Figure 1: **Dynamic Response of Investment**



The figure plots the dynamic response of investment to the return spread between investment and consumption good producers. We estimate local projections in 1 using quarterly data. The left panel shows the response of real per capita investment for developed markets and the right panel shows the response of real per capita investment for emerging markets. The standard errors are corrected using the Newey-West (1987) procedure.

Figure 2: **Dynamic Response of Output**



The figure plots the dynamic response of output to the return spread between investment and consumption good producers. We estimate local projections in 1 using quarterly data. The left panel shows the response of real output per capita for developed markets and the right panel shows the response of real output per capita for emerging markets. The standard errors are corrected using the Newey-West (1987) procedure.

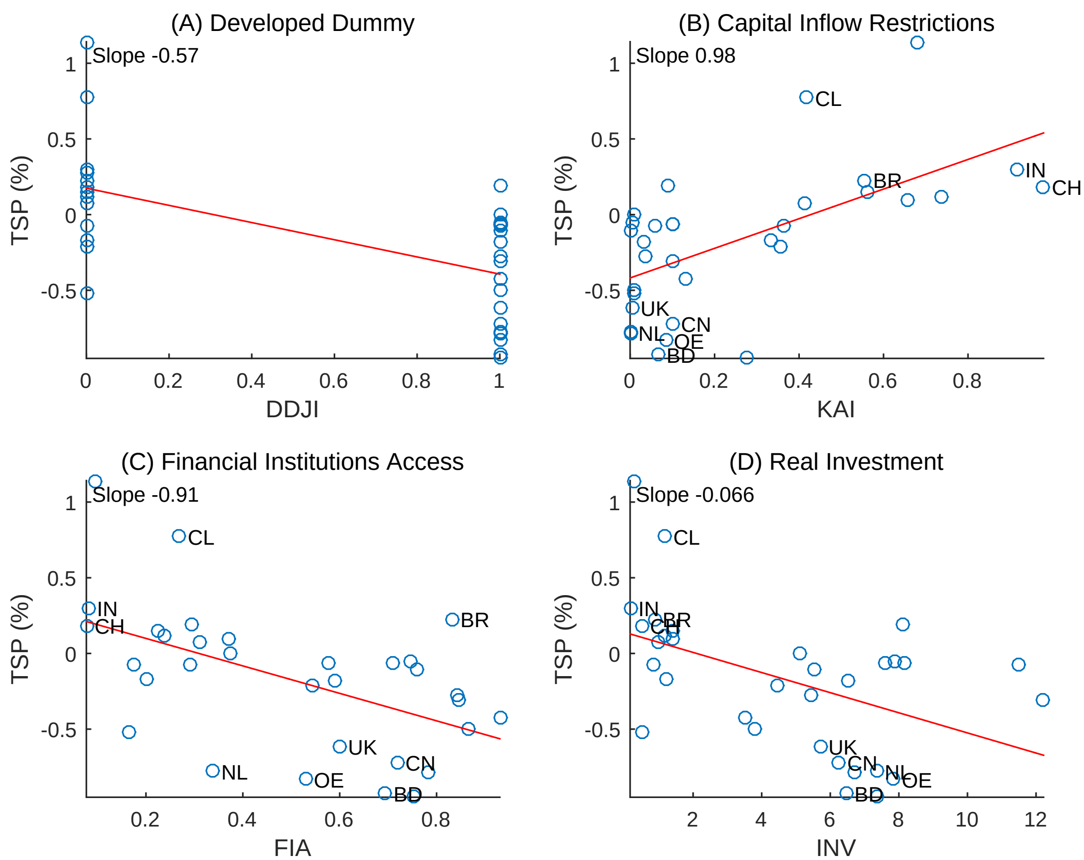


Figure 3: **Determinants of Investment-shock Premium.** This figure plots the time-series investment-shock premium (TSP) against (A) the Dow-Jones Indexes developed-country dummy ($DDJI$), (B) the index for control restrictions on capital inflows (KAI), (C) the index for access to financial institutions (FIA), and (D) the real investment per capita (INV, in thousands) for the sample countries. The two-character country codes are listed in Table 1.

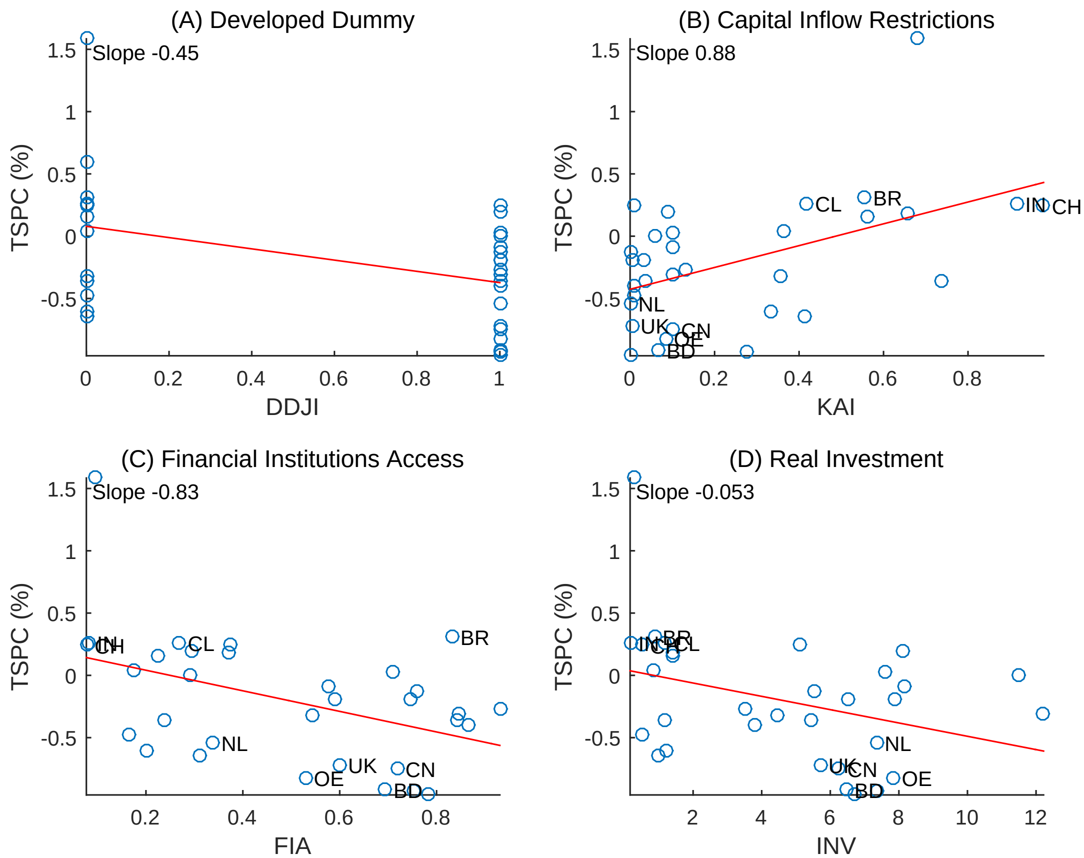


Figure 4: **Determinants of Investment-shock Premium Controlling for Value Effect.** This figure plots the time-series investment-shock premium controlling for the value premium ($TSPC$) against (A) the Dow-Jones Indexes developed-country dummy ($DDJI$), (B) the index for control restrictions on capital inflows (KAI), (C) the index for access to financial institutions (FIA), and (D) the real investment per capita (INV, in thousands) for the sample countries. The two-character country codes are listed in Table 1.

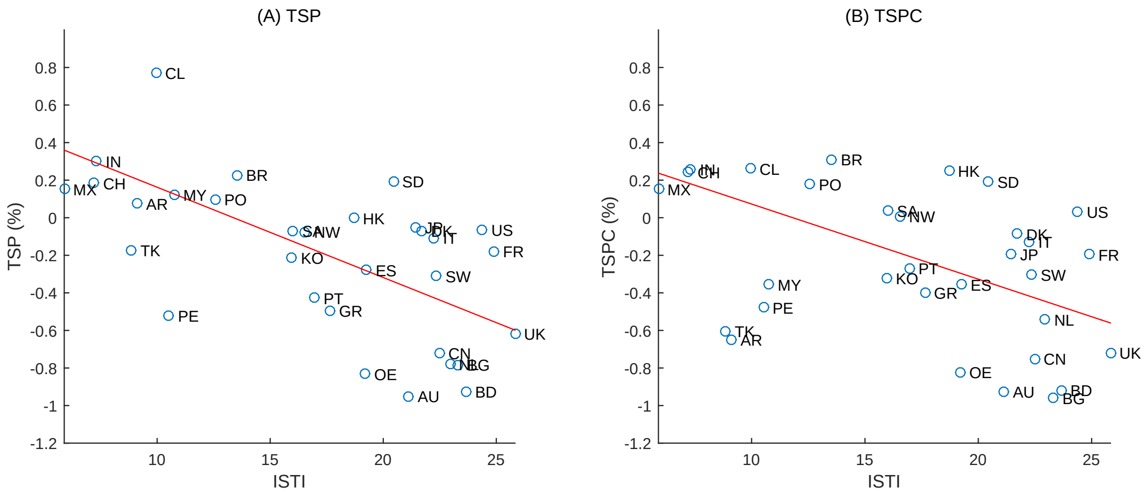


Figure 5: **Composite Index for the Pricing of Investment-specific Technology Shocks.** This figure plots (A) the time-series investment-shock premium (TSP), and (B) the time-series investment-shock premium controlling for the value premium ($TSPC$) against the composite index for the pricing of investment-specific technology shocks, $ISTI$. The two-character country codes are listed in Table 1.

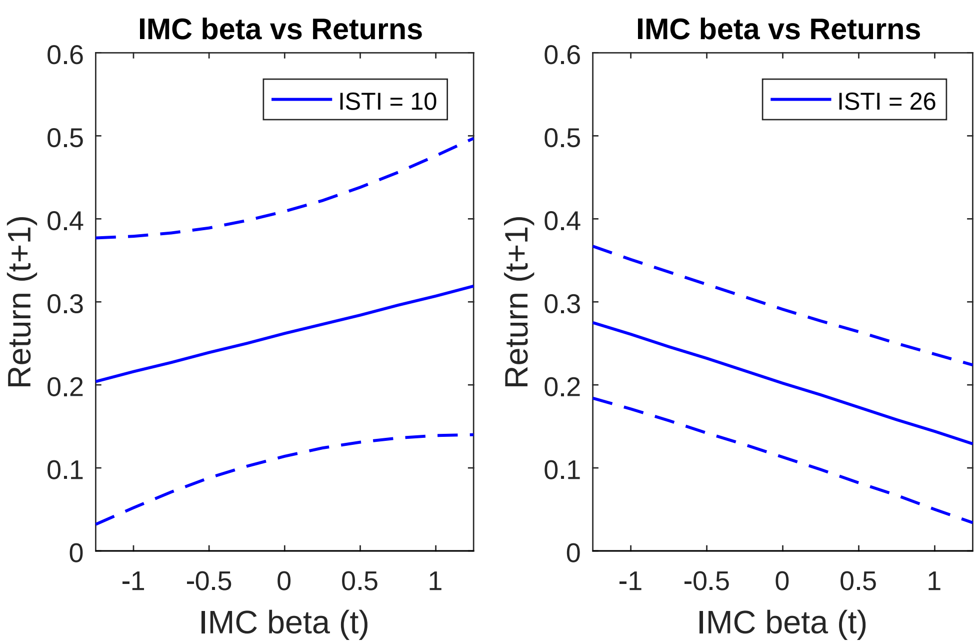


Figure 6: **Exposure to Investment-specific Technology Shocks vs. Stock Returns.** This figure plots the predictions of the fit model 2 at fixed values of ISTI and averaging over the remaining covariates. ISTI is the country level composite index for the degree of IST-shock pricing. The error bands are 90 percent bands based on standard errors using delta method.

Table A1: **Sources of National Input-output Tables**

	Country	Source	Website
Africa	South Africa	The Organisation for Economic Co-operation and Development	http://stats.oecd.org/
Asia, Developed	Hong Kong	Asian Development Bank	http://www.adb.org/data/icp/input-output-tables/outputs
	Japan	Statistics Bureau, Director-General for Policy Planning and Statistical Research and Training Institute	http://www.stat.go.jp/english/data/io/
	South Korea	The Organisation for Economic Co-operation and Development	http://stats.oecd.org/
	Taiwan	National Statistics Republic of China	http://eng.stat.gov.tw/ct.asp?xItem=29540&ctNode=1650&mp=5
Asia, Emerging	China	National Bureau of Statistics of China	http://www.stats.gov.cn/english/statisticaldata/yearlydata/YB2000e/C18E.htm
	India	The Organisation for Economic Co-operation and Development	http://stats.oecd.org/
	Indonesia	The Organisation for Economic Co-operation and Development	http://stats.oecd.org/
	Malaysia	Asian Development Bank	http://www.adb.org/data/icp/input-output-tables/outputs
Australasia, Developed	Australia	Australian Bureau of Statistics	http://www.abs.gov.au/AusStats/ABS@.nsf/MF/5209.0.55.001
Europe, Developed	Austria	The Statistical Office of the European Union	http://epp.eurostat.ec.europa.eu/portal/page/portal/esa95_supply_use_input_tables/data/database
	Belgium	The Statistical Office of the European Union	http://epp.eurostat.ec.europa.eu/portal/page/portal/esa95_supply_use_input_tables/data/database
	Denmark	The Statistical Office of the European Union	http://epp.eurostat.ec.europa.eu/portal/page/portal/esa95_supply_use_input_tables/data/database
	France	The Statistical Office of the European Union	http://epp.eurostat.ec.europa.eu/portal/page/portal/esa95_supply_use_input_tables/data/database
	Germany	The Statistical Office of the European Union	http://epp.eurostat.ec.europa.eu/portal/page/portal/esa95_supply_use_input_tables/data/database
	Italy	The Statistical Office of the European Union	http://epp.eurostat.ec.europa.eu/portal/page/portal/esa95_supply_use_input_tables/data/database
	Netherlands	The Statistical Office of the European Union	http://epp.eurostat.ec.europa.eu/portal/page/portal/esa95_supply_use_input_tables/data/database
	Norway	The Statistical Office of the European Union	http://epp.eurostat.ec.europa.eu/portal/page/portal/esa95_supply_use_input_tables/data/database
	Sweden	The Statistical Office of the European Union	http://epp.eurostat.ec.europa.eu/portal/page/portal/esa95_supply_use_input_tables/data/database
	Switzerland	The Organisation for Economic Co-operation and Development	http://stats.oecd.org/
	UK	The Office for National Statistics	http://www.ons.gov.uk/ons/guide-method/method-quality/specific/economy/input-output–uk-national-accounts/
Europe, Emerging	Greece	The Statistical Office of the European Union	http://epp.eurostat.ec.europa.eu/portal/page/portal/esa95_supply_use_input_tables/data/database
	Turkey	The Statistical Office of the European Union	http://epp.eurostat.ec.europa.eu/portal/page/portal/esa95_supply_use_input_tables/data/database
North America, Developed	Canada	Statistics Canada	http://www5.statcan.gc.ca/subject-sujet/result-resultat?pid=3764&id=2745&lang=eng&type=ARRAY&sortType=1&pageNum=0
	US	The Bureau of Economic Analysis	http://www.bea.gov/industry/io_annual.htm
South America, Emerging	Brazil	The Organisation for Economic Co-operation and Development	http://stats.oecd.org/
	Chile	The Organisation for Economic Co-operation and Development	http://stats.oecd.org/
	Mexico	The Organisation for Economic Co-operation and Development	http://stats.oecd.org/
	Peru	PER Instituto Nacional de Estadstica e Informtica	http://www.inei.gob.pe/bases-de-datos/

This table shows the sources of national input-output tables used to identify investment- and consumption-good industries.